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REVIEW AND PROSPECTUS, FIRST ANNUAL REPORT OF THE RESEARCH AND DEVELOPMENT CENTER FOR LEARNING AND RE-EDUCATION.

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WISCONSIN UNIV., MADISON

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THE 1ST YEAR OF OPERATION OF THE RESEARCH AND DEVELOPMENT CENTER FOR LEARNING AND RE-EDUCATION AT THE UNIVERSITY OF WISCONSIN WAS REVIEWED. BASIC RESEARCH IN CONCEPT LEARNING WAS CONDUCTED BY MEANS OF LABORATORY EXPERIMENTS AND COMPUTER SIMULATION. CONCEPT LEARNING IN THE SUBJECT AREAS OF MATHEMATICS, ENGLISH COMPOSITION, SCIENCE, SPEECH, AND POLITICAL SCIENCE WAS INVESTIGATED BY MEANS OF MODEL LESSONS AND FIELD TESTING. COORDINATED PROJECTS WERE BEGUN IN THE FIELDS OF THE CULTURALLY DISADVANTAGED, ADULT RE-EDUCATION, SOCIAL VARIABLES IN LEARNING, INSTRUCTIONAL TELEVISION, AND METHODOLOGY. NEW PROJECTS AND PLANS TO BE ADDED TO THE RESEARCH PROGRAM INCLUDE LABORATORY EXPERIMENTS ON PROBLEM SOLVING AND PROJECT "MODELS" (MAXIMIZING OPPORTUNITIES FOR DEVELOPMENT AND EXPERIMENTATION IN LEARNING IN THE SCHOOLS). PROJECT "MODELS" WAS DEVELOPED TO FORMULATE SIGNIFICANT RESEARCH PROBLEMS, TO ESTABLISH RESEARCH AND INSTRUCTIONAL UNITS WITHIN PILOT SCHOOLS OF THE SCHOOL SYSTEM TO STUDY AND MODIFY SCHOOL OPERATIONAL STRUCTURES, AND TO STUDY THE CHANGE PROCESSES WHEREBY SCHOOLS INTRODUCE INNOVATIONS AND MAKE ADAPTATIONS. FOR RELATED REPORTS SEE AA 000 061 AND AA 000 068. (TC)

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REVIEW AND PROSPECTUS

FIRST ANNUAL REPORT OF THE RESEARCH AND DEVELOPMENT CENTER FOR LEARNING AND RE-EDUCATION

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THE UNIVERSITY OF WISCONSIN
MADISON, WISCONSIN

U.S. OFFICE OF EDUCATION
Center No. C-03 / Contract OE 5-10-154

Review and Prospectus,

First Annual Report

of the

Research and Development Center

for Learning and Re-Education

University of Wisconsin
2218 University Avenue
Madison, Wisconsin

1965

The research and development reported herein was performed pursuant to a contract with the United States Office of Education, Department of Health, Education, and Welfare, under the provisions of the Cooperative Research Program.

Center No. C-03 / Contract OE 5-10-154

POLICY BOARD OF THE CENTER

Max R. Goodson, Professor of Educational Policy Studies
Co-Director, Administration

Herbert J. Klausmeier, Professor of Educational Psychology
Co-Director, Research

Lee S. Dreyfus, Professor of Speech and Radio-TV Education
Coordinator of Television Activities

John Guy Fowlkes, Professor of Educational Administration
Advisor on Local School Relationships

Chester W. Harris, Professor and Chairman of Educational Psychology
Associate Director, Research

Burton W. Kreitlow, Professor of Agricultural and Extension Education
Coordinator of Adult Re-Education Activities

Julian C. Stanley, Professor of Educational Psychology
(on leave September 1, 1965 - August 31, 1966)

Lindley J. Stiles, Dean of the School of Education
Advisor on Policy

Henry Van Engen, Professor of Mathematics and Curriculum & Instruction
Associate Director, Development

From the proposal for this Center to the United States Office of Education, submitted April 11, 1964:

> The central objective of the proposed Center is to improve the efficiency of learning, both formal and informal, by children, youth and adults. How learning takes place—particularly the development of concepts and problem-solving or thinking abilities essential to the mastery of school subjects and vocational skills—will be investigated through sustained, systematic basic and applied research that utilizes the resources of the University of Wisconsin and the educational agencies of the State of Wisconsin. Outcomes of learning in the cognitive domain, especially concepts and problem solving, will be given attention as one aspect of the general objective. Outcomes in the affective domain also will be treated since they are critical for all students and are especially critical in re-education programs.

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INTRODUCTION

HISTORY

The contract between the University of Wisconsin and the United States Office of Education establishing the Research and Development Center for Learning and Re-Education was signed on August 6, 1964. The high goals held for the Center were expressed by the principals to the signing in a number of ways.

University President Fred Harvey Harrington said that the signing denoted "an important day in the history of the University. This agreement marks the culmination of years of effort devoted to the improvement of the research capabilities of the School of Education, and opens the way to still greater developments."

Herbert J. Klausmeier, Co-Director for Research, described the goals of the Center. "Research emphases will be on learning by children and youth in normal school situations. Especially stressed will be the learning of concepts and problem-solving techniques in mathematics and other basic subjects."

Lindley J. Stiles, Dean of the School of Education and Co-Director for Administration stated, "The establishment of this Center is the culmination of many years of cooperative effort to secure the kind of support needed to improve learning in the schools through research. The School of Education at the University of Wisconsin will lead the national effort toward this goal. The full resources of the School of Education will back the Center."

John Guy Fowlkes, Director of the Wisconsin Improvement Program, pledged the full cooperation of the schools affiliated with the W. I. P.

The agreement was described by Howard F. Hjelm, director of basic research for the U. S. Office of Education, as following the new pattern in educational research of "full institutional commitment. The University has pledged itself to fully investigate the problem of learning and to disseminate research findings in a way which will bring about definite changes in school practices."

Hjelm found the University "perfectly suited" for the commitment it had accepted. "The University was chosen because of the exceptional quality of its educational researchers, because of its excellent relationship with local schools and with the State Department of Public Instruction, and because of the wholehearted dedication to the project existing in Madison."

Formal signing of the contract signified the end of a year of proposal development and review. Professor Klausmeier instigated the plan for a center focusing research on concept learning and wrote the proposal with the aid of Dean Lindley J. Stiles and Professors Chester W. Harris, Frank B. Baker, Thomas J. Johnson, and Henry Van Engen. Their guide in preparing the document was a publication of the Cooperative Research Program of the U. S. Office of Education.

Application Instructions for Research Contracts, OE-12017. At that time the Cooperative Research Program included six major programs: (1) basic and applied research, (2) demonstration, (3) curriculum improvement, (4) small contract, (5) research and development centers, and (6) developmental activities. Further description of the research and development centers was given in the publication as follows:

> Research and development centers are designed to concentrate human and financial resources on a particular problem area in education over an extended period of time in an attempt to make a significant contribution toward an understanding of, and an improvement of educational practice in, the problem area. More specifically, the personnel of a center will:
>
> 1. Conduct basic and applied research studies, both of the laboratory and field type.
> 2. Conduct development activities designed to translate systematically research findings into educational materials or procedures, and field test the developed products.
> 3. Demonstrate and disseminate information about the new programs or procedures which emerge from the research and development efforts. These activities may include demonstrations in a natural, or operational, setting, the preparation of films, tapes, displays, publications, and lectures, and the participation in symposia and conferences.
> 4. Provide nationwide leadership in the chosen problem area.(page 27)

Following preliminary acceptance by the U. S. O. E. of the Center proposal, a six-member review panel was sent to the University to determine feasibility of the location.[1] The following description of the site visit, May 18, 1964, indicates the cooperative efforts at this University that were implied in the specifications for research and development centers.

In addition to conducting a teleconference with University President Fred Harvey Harrington, members of the Site Visit Panel held discussions on various topics with the following groups:

ORGANIZATION AND BACKGROUND OF THE PLAN FOR THE CENTER

> Dr. Lindley J. Stiles, Dean, School of Education; Dr. Wilson B. Thiede, Associate Dean, School of Education; Dr. Herbert J. Klausmeier, Director of the Learning Laboratory and Research Center; Dr. Chester W. Harris, Professor of Educational Psychology; Dr. Julian C. Stanley, Director of the Laboratory of Experimental Design.

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[1]The panel members for the Site Visit were Dr. Ralph W. Tyler (Chairman), Director, Center for Advanced Study in the Behavioral Sciences, Stanford, California; Dr. Alan Pifer, Vice President, Carnegie Corporation, New York City; Dr. James L. Jarrett, President, Western Washington State College, Bellingham, Washington; Dr. William P. Robinson, Jr., Commissioner of Education, State Department of Education, Providence, Rhode Island; Dr. Benjamin Bloom, Professor of Education, University of Chicago; Dr. Howard F. Hjelm (Executive Secretary), Research Coordinator, Cooperative Research Branch, U. S. Office of Education.

DISCUSSIONS WITH RESEARCHERS

Research in the Cognitive Domain: Dr. Herbert J. Klausmeier, Human Learning; Dr. Frank B. Baker, Computer Technology; Dr. Henry Van Engen, Mathematics; Dr. Donald H. Bucklin, Zoology; Dr. Harry A. Waisman, Medicine.

Research in the Affective Domain: Dr. Chester W. Harris, Educational Psychology; Dr. Thomas J. Johnson, Educational Psychology; Dr. Edgar F. Borgatta, Sociology; Dr. David A. Baerreis, Anthropology; Dr. William H. Sewell, Sociology.

Research on Re-Education: Dr. Burton W. Kreitlow, Educational Policy Studies; Dr. Warren O. Hagstrom, Sociology; Dr. Julian C. Stanley, Educational Psychology; Dr. Douglas G. Marshall, Rural Sociology; Dr. Clara Penniman, Chairman, Political Science.

INTERAGENCY COOPERATION

Mr. Angus B. Rothwell, State Superintendent of Public Instruction; Mr. William C. Kahl, First Assistant Superintendent of Public Instruction; Dean Robert A. Alberty, Graduate School; Dr. Karl E. Krill, Special Assistant to the President; Dean Lindley J. Stiles, School of Education.

COOPERATION WITH THE SCHOOLS

Mr. Angus B. Rothwell, State Superintendent of Public Instruction; Mr. George Tipler, Executive Secretary, Wisconsin Association of School Boards; Dr. Dwight Teel, Assistant Superintendent, Milwaukee Public Schools, Division of Curriculum and Instruction; Dr. Robert D. Gilberts, Superintendent, Madison Public Schools; Mr. Paul M. Loofboro, Superintendent, West Bend Public Schools; Mr. Fred R. Holt, Superintendent, Janesville Public Schools.

COOPERATION WITHIN THE UNIVERSITY

Dean H. Edwin Young, Letters and Science; Dean James F. Crow, Medicine; Dean Theodore J. Shannon, Extension; Dean Erwin A. Gaumnitz, Commerce.

DEVELOPMENT AND DISSEMINATION ACTIVITIES

Mr. Robert C. Van Raalte, Assistant Superintendent, State Department of Public Instruction and Director of Instructional Services; Professor Lee S. Dreyfus, WHA-TV, Radio-TV Education and Speech; Dr. Percy H. Tannenbaum, Director, Mass Communications; Dr. Herbert J. Klausmeier, Professor of Educational Psychology and Director of the Learning Laboratory and Research Center; Dr. Burton W. Kreitlow, Professor of Education, Professor of Agricultural and Extension Education; Dr. Lindley J. Stiles, Dean, School of Education.

POLICY COMMITTEE

Dr. Herbert J. Klausmeier, Co-director for Research; Dr. Chester W. Harris, Professor of Educational Psychology; Dr. Burton W. Kreitlow, Professor of Education, Professor of Agricultural and Extension Education; Dr. Julian C. Stanley, Director of the Laboratory of Experimental Design; Dr. Henry Van Engen, Professor of Mathematics and Education; Dr. Lindley J. Stiles, Dean, School of Education, Co-director for Administration.

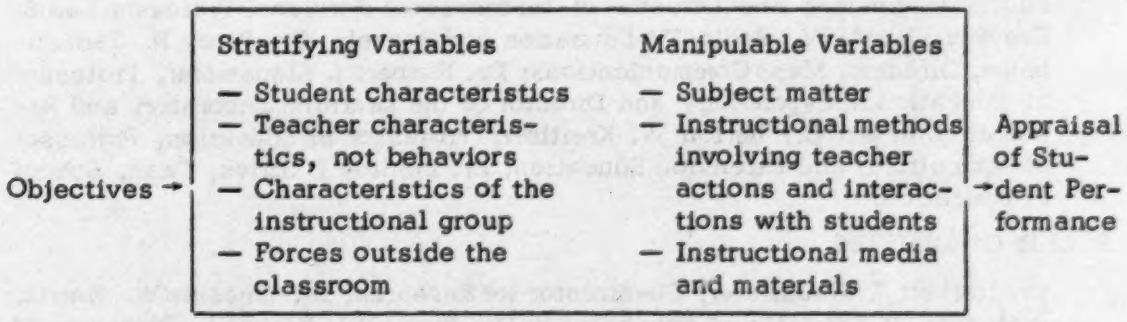
The Center for Learning and Re-Education at the University was the third research and development center to be established. In the fall of 1963, contracts had been signed with the Universities of Oregon and Pittsburgh for the Center for the Advanced Study of Educational Administration and the Learning Research and Development Center, respectively. Harvard University established the Center for Research and Development on Educational Differences shortly after the Center at Wisconsin was established. By late 1965 there were five more centers at the University of California (Berkeley), Stanford University, University of Georgia, University of Texas, and New York City universities, each focusing on one problem or topic of significance to education.

THEORETICAL BASIS

In planning sessions and early work sessions a functionalist theory of instruction was outlined. The design, shown in Figure 1, provides a referent for all research in classroom learning in the Center. Efficiency of learning, inferred from performance of the students, is a function of seven main groups of variables described as: manipulable—subject matter, instructional method, instructional media and materials; and stratifying—teacher characteristics, student characteristics, instructional—group characteristics, and forces outside the classroom.

Developmental activities implementing this theory are carried out in two general patterns. One leads directly from review of research into instructional materials which are field tested and refined; the other pattern also begins with a review of research but entails a good deal of laboratory research and small scale experimentation in the schools before instructional materials are developed and tested in the schools. This year the two patterns were utilized simultaneously in the development of materials for mathematics instruction and have proved to be highly successful. Incorporation of the results of basic research into instructional programs is another implementation of the two patterns.

Figure 1
Design for a Theory of Instruction


Stratifying Variables
— Student characteristics
— Teacher characteristics, not behaviors
— Characteristics of the instructional group
— Forces outside the classroom
Manipulable Variables
— Subject matter
— Instructional methods involving teacher actions and interactions with students
— Instructional media and materials
Objectives
Appraisal of Student Performance

More Detailed Outline of Variables to be Considered
in Designing an Instructional Theory

I. Objectives
II. Student Characteristics
  A. Cognitive
    1. Previous achievements or experience related to the task
    2. General intellectual ability
    3. Specific intellectual abilities
    4. Method or strategy of learning already developed, i.e., cognitive style
  B. Psychomotor
  C. Affective (Based on Krathwohl, D. R., Bloom, B. S., & Masia, B. B. *Taxonomy of Educational Objectives. Handbook II: Affective Domain.* New York: McKay, 1964.)
    1. Receiving (Attending)
    2. Responding
    3. Valuing
    4. Organization
    5. Characterization by a value or value complex
  D. Physical
III. Teacher Characteristics (parallel to those of learner)
  A. Cognitive
  B. Psychomotor
  C. Affective
  D. Physical
IV. Characteristics of the Instructional Group
  A. Cohesiveness
  B. Attitudes toward learning and instruction
V. Forces Outside the Classroom
  A. Affecting students
    1. Home and neighborhood
    2. Social class
  B. Affecting teachers and materials
    1. Administrative support
    2. Supervisory, guidance, psychological assistance
VI. Subject Matter
  A. Fields (e.g., math, English)
  B. Organization of subject matter
  C. Content of subject matter (especially relevant to concepts)
    1. Complexity of the material
    2. Type of concept
    3. Type of material in which the concepts are embedded (figural, symbolic, semantic)
    4. Instances of the concept
    5. Mode of presentation of instances
    6. Meaningfulness of the material

More Detailed Outline... (continued)

VII. Instructional Methods Involving Teacher (or Experimenter) Actions and Interactions with Students
  A. Involving short-term tasks under experimental conditions
  B. Involving teacher actions and interactions with students in classroom situations
VIII. Instructional Media and Materials
  A. Audio
  B. Visual
  C. Audio-Visual
  D. Printed
IX. Appraisal of Student Performance

TRAINING IN EDUCATIONAL RESEARCH

The training function of the Center during its first year, including the training of educational researchers, cannot be too greatly emphasized. Future leaders in educational research, graduate students in many specialties receive the best training that is possible at the University of Wisconsin. Also, the professorial staff participate in an organized weekly colloquium and at informal work sessions, the latter often with Professors C. W. Harris, Henry Van Engen, or Herbert J. Klausmeier. Thus, training of the staff through mutual interchange was effected.

The weekly colloquium served instructional and internal communcation purposes with the staff of the Center. We are grateful to the psychology department of the University for permitting us to participate in lectures by Dr. Irwin Maltzman, Dr. Kenneth Spence, and Dr. David McClelland. We appreciate the knowledge and experience shared by speakers coming to the Center. These people contributed significantly to research training in the Center, by conferring with work groups in the Center on current projects. They were: Dr. Richard C. Anderson, University of Illinois; Arthur W. Staats, Institute for Human Learning, Berkeley, California; Merlin C. Wittrock, University of California, Los Angeles; Norris Sanders, Manitowoc Public Schools; Richard Suchman, U. S. Office of Education; Robert Glaser, University of Pittsburgh; Joe Byers, University of California; Carl Bereiter, University of Illinois; Arthur Jensen, University of California, Berkeley; Joseph Scandura, Florida State University; and Kenneth Feigenbaum, Brandeis University. During 1965-1966 the colloquium series will continue, but on a more formal basis, with the expectation of publishing the paper in book form.

Another aspect of graduate-student training is support while gathering data for a thesis of direct concern to a problem of the Center. Theses so prepared will be distributed as technical reports of the Center.

Not to be overlooked in training is that most of the 25 professors associated with the Center introduce new concepts emerging from Center activities into the teacher education program of the University. Each professor associated with the Center normally teaches at least one class per semester in a department of

the University. The Conference on the Analyses of Conceptual Learning which was held at the Center October 18-21, 1965, brought a number of noted researchers to the Center. A book of the proceedings of the conference is planned.

The training function of the Center during 1965-66 will be greatly enlarged due to the number of graduate students who will be associated with the Center and, also, due to the increase in the number of planning sessions and institutes conducted with school people.

ORGANIZATION

As experts in human learning, experimental design, instructional media, adult education, educational administration, and mathematics, the members of the Policy Board testify to the interdisciplinary nature of the Center. They are responsible for all major policy decisions affecting the Center's operation including approval of long-range research plans. A brief sketch of each policy board member follows.

Herbert J. Klausmeier, who initiated the proposal for the Center and is now Co-director for Research, is respected by students and teachers alike, exemplifying the dual professorial role. He has authored a number of books on teaching and learning; frequently publishes in educational and psychological journals; and has completed eight major research projects in the last 10 years, most of them in cooperation with the Wisconsin public schools. Co-director Max R. Goodson is concerned with the administration of the Center. While at Ohio State University he designed an early large scale research and change program concerned with school administration. His writings have dealt with questions of policy and organization regarding educational research and improvement, and as a fellow of the National Training Laboratories he has worked closely with behavioral scientists in a variety of study and training efforts. He came to Madison in June from Boston where he had been Editor-in-Chief of the high school division of Ginn and Co. and previously Dean of the School of Education at Boston University. Both of these men began their careers as public school teachers.

Lee S. Dreyfus, coordinator of instructional television activities in the Center, is general manager of WHA-TV at the University. He is recognized as a competent producer, researcher, and systems designer in educational television.

John Guy Fowlkes serves as the Center's advisor on local school relationships. He successfully initiated the Wisconsin Improvement Program in 1959, to explore crucial areas in education, and has served as a consultant to educational systems in this country and abroad.

Chester W. Harris, associate director for research, is noted as a research strategist and an educational planner. During two summer months of 1965, he and research assistant Wayne Fredrick interviewed leading European researchers and attended the Quadrennial Congress of the International Association for the Advancement of Educational Research at Cambridge where Professor Harris chaired a five-member panel on "Educational Research in the U. S. A."

The Center's coordinator of adult re-education activities, Burton W. Kreitlow, was largely responsible for development of the University's graduate programs in adult education. He is president-elect of the NEA Department of Rural

Education and Chairman of the NEA Commission on the Individual and the School.

Julian C. Stanley, at the Institute for Advanced Study in the Behavioral Sciences on a National Institute of Mental Health Fellowship, September 1, 1965 to August 31, 1966, coordinated activities regarding the culturally disadvantaged during the first year of the Center's operation, an interest stemming from his membership on the University Committee on Cooperation with Negro Universities. Dr. Stanley is president-elect of the American Educational Research Association and president-elect of Division 15, Educational Psychology, of the American Psychological Association. (Co-director Klausmeier and Professor Arthur W. Staats are directing activities involving the culturally disadvantaged in school settings during 1965-1966.)

Lindley J. Stiles has served as Dean of the School of Education at the University for 10 years and is a recognized leader in development of a research approach to improving education. He served as administrative co-director of the Center until May 31, 1965, and is now advisor on policy.

Henry Van Engen, associate director for developmental activities, is author/director of the televised Patterns in Arithmetic instructional series and is a frequent contributor to mathematics education journals. As a consultant to the Ford Foundation Chilean Project, he was on leave in Chile during the first semester of the 1964-65 school year.

Staff who are not on the Policy Board but direct important Center programs are introduced below. All staff members, including Policy Board, are budgeted in the Center one-fourth to three-fourths time, remaining able to teach in the teaching department in which they hold rank and maintain other professional activities.

Professor Milton Pella directs the project on concept learning in science. He is president of the National Association for Research in Science Teaching and is often called on for consultation with schools improving or developing a science curriculum.

Moving to Madison from Arizona, Arthur W. Staats joined the staff of the University and the Center this summer. He is directing experiments in which the principles and procedures of learning theory which he has extensively researched for a number of years are being applied in school settings.

Professor Nathan S. Blount is in charge of English instruction for the Center. He is Teaching Materials Editor and author of the Annual Summary of Research for *The English Journal* and frequently consults with schools on instructional procedures as well as language arts programs.

Professor Ronald Allen, who directs research on concepts in speech for the Center, came to the University of Wisconsin in 1963 with a joint appointment in the Departments of Speech and Curriculum and Instruction. He is coauthor of *Contemporary American Speeches* published in 1965.

Before joining the Center as computer specialist, Frank B. Baker, Associate Professor of Educational Psychology, had had seven years programming experience in conjunction with teaching and authored a number of articles relating to the computers.

Robert Boyd joined the staff of the University in 1962 in the Department of Curriculum and Instruction where he is primarily concerned with adult re-education.

Gary Davis joined the Center this summer after receiving his Ph.D. in psychology at Wisconsin. He recently completed a critical review of recent theory and research in human problem solving and is working on a second review concerned with the training of originality and creative problem solving.

Jack Dennis, Professor of Political Science, has been at the University of Wisconsin for two years. His main research focus has been political socialization.

Calvin Gale, working in the science project, is vice president and a member of the board of directors of the Central Association of Science and Mathematics Teachers.

Gary Gumpert is a producer-director for WHA-TV on campus and will serve as the producer-director for all Center televised instructional programs.

Warren Hagstrom, Assistant Professor of Sociology, has written a number of articles and books on various groups, the latest book entitled *The Scientific Community*.

George O'Hearn received his training at the University of Wisconsin and after receiving his Ph.D. remained at the University, with a joint appointment in the Departments of Zoology and Curriculum and Instruction, to continue his research in the teaching of science.

Wayne Otto joined the Center staff in the fall of 1965. He was director of the summer 1965 Reading Clinic at the University and has published extensively in psychological and educational journals.

Bruce Westley is Professor of Journalism and Radio-TV Education and is also the Research Director for the Division of Radio-TV Education at the University.

Professor Thomas J. Johnson's primary research interests are motivation and perception. He directed research related to motivation for the Center until his departure September 3, 1965.

Instructor Richard Dickman was the teacher for the televised mathematics instruction prepared during the 1964-1965 school year.

In addition to the 25 professors on the Center staff, there were 9 research associates, 52 research and project assistants, and an administrative and secretarial staff.

Two local advisory groups are available for consultation with staff of the Center—the University Advisory Panel composed of Professors from 16 departments of the University[2] and the Inter-Agency Consultants representing Univer-

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[2] Members of the University Advisory Panel during the school year 1964-65 are as follows: E. James Archer, Professor and Chairman, Psychology; Leonard Berkowitz, Professor of Psychology; Eugene P. Boardman, Professor of History; Edgar F. Borgatta, Professor and Chairman, Sociology; Donald H. Bucklin, Professor, Zoology; Fredrick W. Haberman, Professor and Chairman, Speech; Harry F. Harlow, Professor of Psychology, Director Primate Research Center; Harold B. McCarty, Professor and Director of Radio-TV Education, Executive Director, State Radio Council; Jack M. McLeod, Assistant Professor of Journalism, Assistant Director, Mass Communications Research Center; Robert C. Pooley, Professor, Integrated Liberal Studies and English, Director, English Arts Project, State Department of Public Instruction; William H. Sewell, Vilas Research Professor,

sity administration, school administration, and agencies concerned with improving education.[3]

A National Evaluation Committee was selected for annual review of the progress of the Center. Members of this group receive reports from the Center staff and in turn report to the Policy Board with an assessment of the progress of the Center.[4] At the first meeting of the National Evaluation Committee in April, 1965, members heard short reports from each principal investigator in the Center. The second meeting, in October, 1965, in accordance with a request from the Committee, consisted of extensive reports in three areas—basic research in concept learning, mathematics, and English—as well as shorter reports from each other principal investigator in the Center. At subsequent meetings the National

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Sociology; Theodore J. Shannon, Dean of Extension Division, Lecturer in Education; Harry P. Sharp, Professor of Sociology, Director, Wisconsin Survey Research Laboratory; C. Harvey Sorum, Professor of Chemistry; Percy H. Tannenbaum, Professor of Journalism, Director of Mass Communications Research Center; Harry A. Waisman, Professor of Pediatrics; L. Clinton West, Assistant Professor of Curriculum and Instruction, Director, Multimedia Instructional Laboratory; Helen C. White, Professor of English; Eugene A. Wilkening, Professor of Rural Sociology.

[3] Inter-Agency Consultants: Robert L. Clodius, Vice President of the University in charge of Academic Affairs; John Guy Fowlkes, Director of Wisconsin Improvement Program; Robert D. Gilberts, District Administrator, Madison Public Schools; C. L. Greiber, Director of State Board of Vocational and Adult Education; Fred R. Holt, District Administrator, Janesville Public Schools; Philip Lambert, Professor, Educational Psychology; Paul M. Loofboro, District Administrator, West Bend Public Schools; LeRoy E. Luberg, Dean of Public Services; Carl N. Neupert, Lecturer, Preventive Medicines, State Board of Health; John Prasch, District Administrator, Racine Public Schools; Angus B. Rothwell, State Superintendent of Public Instruction; Harris E. Russell, Director of Instructional Services, Racine Public Schools; Dwight Teel, Assistant Superintendent, Curriculum and Instruction, Milwaukee Public Schools; George Tipler, Executive Secretary of the Wisconsin School Board Association; H. C. Weinlick, Executive Secretary of the Wisconsin Education Association.

[4] Members of the National Evaluation Committee were: Truman Botts, Professor, Department of Mathematics, University of Virginia; Henry Chauncy, President, Educational Testing Service; Jack V. Edling, Director, Teaching Research Division, Oregon State System of Higher Education; John H. Fisher, President, Teachers College, Columbia University; Andrew Torrence, Professor and Dean of Academic Affairs, Tuskegee Institute; Samuel Brownell, Superintendent, Detroit Public Schools; Martin Deutsch, Director, Institute for Developmental Studies, New York Medical College; Alvin C. Eurick, President, Aspen Institute for Humanistic Studies; Roderick F. McPhee, Professor, Graduate School of Education, Harvard University; Benton Underwood, Professor, Department of Psychology, Northwestern University.

Evaluation Committee will receive reports in depth from three different principal investigators.

ARTICULATION WITH SCHOOLS

In its first year of operation the Center maintained a number of means of communication with the schools. Five schools were represented in the previously discussed Inter-Agency Consultants group which helped in preliminary planning for the Center. Eight additional schools met with representatives of the five as a Schools-Center Planning Committee.[5] The mathematics education group of the Center regularly called together an Advisory Committee whose activities are described in a later section of this report. Over one hundred schools participated in experiments conducted by Center staff.[6]

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[5] Schools-Center Planning Committee members were: Robert D. Gilberts, District Administrator, Madison; Fred R. Holt, District Administrator, Janesville; Paul M. Loofboro, District Administrator, West Bend; John Prasch, District Administrator, Racine; Harris E. Russell, Director of Instructional Services, Racine; Dwight Teel, Assistant Superintendent, Curriculum and Instruction, Milwaukee; Elton H. Boettcher, Secondary Supervisor, Wausau; Homer DeLong, District Administrator, Eau Claire; D. J. Huenink, District Administrator, Monroe; Leslie W. Johnson, District Administrator, Sheboygan; Robert Ames, District Administrator, Wisconsin Heights School, Black Earth; Norris M. Sanders, General Supervisor K-12, Manitowoc; Frank J. Splitek, General Supervisor K-12, Kenosha; and Russell S. Way, District Administrator, Green Bay.

[6] Schools used in Center experimentation were: Black Earth Elementary School; Blanchardville Elementary School; Boscobel Elementary School; DeForest Elementary School; Dodgeville Elementary School; Edgerton Elementary School; Elroy Elementary School; Fennimore Elementary School; City Elementary School, Hillsboro; Lodi Elementary School; Mazomanie Elementary School; McFarland Elementary School; Sauk Trail Elementary School, Middleton-Springfield; Lincoln Elementary School, Monroe; La Crosse Street Elementary School, Mauston; Nichols Elementary School, Monona Grove; New Glarus Elementary School; New Lisbon Elementary School; Oakfield Elementary School; Kegonsa Elementary School, Stoughton; Northside Elementary School, Sun Prairie; Southside Elementary School, Sun Prairie; Wisconsin Dells Elementary School; Verona Elementary School; Madison Elementary Schools; Milwaukee Elementary Schools; St. Dennis and Immaculate Heart of Mary, Madison Diocese Schools; Central High School, Madison; Lincoln High School, Manitowoc; Washington Park High School, Racine; West Bend High School; Monroe High School; Wisconsin Heights High School, Black Earth-Mazomanie; Beaver Dam High School; Jefferson High School; Homestead Union High School, Thiensville-Mequon.

School representatives on the Inter-Agency Consultant panel were asked to participate when initial plans were made for the Center. They were selected as representative of a variety of sizes of school systems, all willing to innovate and adapt. The eight additional schools represented on the Schools-Center Planning Committee were selected for the same reasons. In the near future the Committee will be enlarged by at least three to include representatives from the parochial schools, the private schools, and the vocational, technical, and adult system. About 1/3 of the public school population in the state is now represented on this Committee.

We have been fortunate to have a representative from the State Department of Public Instruction on our staff this year to establish liaison between the Center and the schools. Chester W. Spangler's knowledge of the schools' requirements and operations has resulted from his various experiences as a Wisconsin educator: teacher, principal, and district administrator. For over 10 years he has been in the office of the State Department of Public Instruction, first, as a secondary supervisor and, just before joining the Center, as administrator of a Ford Foundation grant for discovering, developing, and disseminating worthwhile innovations in the schools. As Center associate, Mr. Spangler has helped to schedule research in the schools and has also consulted with a number of systems concerning their involvement in future large-scale Center projects. During the first year Mr. Spangler was not formally appointed to the Center but served on our staff on a leave of absence from the State Department of Public Instruction. The Department is now selecting a person to serve as Staff Advisor to the State Superintendent and as Associate Director of the Center for the duration of our contract.

Mr. Arnold Chandler, Mathematics Supervisor in the State Department of Public Instruction, has also been affiliated with the Center this year. He was invited to join the staff as head of the mathematics group in Dr. Van Engen's absence during the first semester and remained to consult on the experimental television instruction in mathematics conducted during the second semester.

Madison's winter weather postponed the formal meeting of the Schools-Center Planning Committee until April 2 although various members of the committee had met previously with representatives of the State Department of Public Instruction and the Center. The main purpose of the April meeting was to establish areas for and efficient means of cooperation between the schools and the Center. In speaking to the group, Drs. Klausmeier and Harris of the Center emphasized the importance of open communication with the schools and the need for specific researchable questions from the schools. Communications systems within the schools are of particular importance to the Center because of its decision to work with persons responsible for teacher training rather than directly with the teachers, except when conducting basic research and when field testing materials and procedures in the schools. Representatives of the Milwaukee, Racine, and West Bend systems outlined their procedures for efficient internal communication of general problems and promising innovations. Relationships between the schools, the Center, and related agencies were clarified by officials of the University Extension Division, the Wisconsin Improvement Program, and the State Department of Public Instruction.

School representatives cited five areas that were of pressing and continual concern to them: determining students' readiness for various learning activities, motivating students whose formal education will terminate with high school graduation, providing for culturally-disadvantaged and/or slow-learning children, receiving aid in conducting research projects, and evaluating their instructional program. These needs fall within the stated concerns of the Center and offer guidelines for cooperative planning of research and development activities by the Center and the schools. The need for a school research clearing house was expressed by representatives of all schools. The Center and State Department of Public Instruction are serving as a clearing house for activities related to education of the culturally disadvantaged, starting in September, 1965, and plan to extend this function through a monthly seminar dealing with schools-Center research and development concerns.

BASIC RESEARCH IN CONCEPT LEARNING

LABORATORY EXPERIMENTS

Concept learning was selected as the major focus of the Center because we believe that concepts comprise a substantial part of organized knowledge in all subject fields. Much of the research on concept attainment during the first year was carried out in the laboratory and was a continuation and extension of the research conducted by Professors Klausmeier and Harris during the three years 1961-1964.[1]

Graduate students in educational psychology and experimental design who are affiliated with the Center formed a research group and greatly extended the scope of the research in two main directions. First, the entire domain of laboratory experimentation in concept attainment was defined. Second, knowledge generated in experiments and collected from previous research was related to experimentation in school settings.

Three major activities were completed in the interpretation of laboratory concept-attainment research: developing a taxonomy of variables in concept learning (Table 1), hypothesizing mental processes in concept learning, and identifying and abstracting the articles dealing with concept learning and problem solving during the period 1950-1964. Generalizations accruing from these activities will be tested in several subject fields with school children and should be of practical value to writers in developing instructional material and to teachers in improving their methods.

The first group undertaking was a bibliography of the research on concept learning and problem solving published between 1950 and 1964. A definition of *concept*, the taxonomy of variables, and this bibliography make up the first technical report of the Center.[2] All concept-learning articles have been abstracted and form the nucleus for subsequent technical reports planned to present major generalizations that can be drawn from the research.

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[1]Klausmeier, H. J., Harris, C. W., & Wiersma, W. *Strategies of learning and efficiency of concept attainment by individuals and groups.* U. S. Office of Education Cooperative Research Project No. 1442. Madison: Univer. of Wisconsin, 1964.

[2]Klausmeier, H. J., Davis, J. K., Ramsay, J. G., Fredrick, W. C., & Davies, Mary H. *Concept learning and problem solving: A bibliography, 1950-1964.* Tech. Rep. No. 1, Ctr. for Learning and Re-education, C-03, OE 5-10-154. Madison: Univer. of Wisconsin, 1965.

TABLE 1

Taxonomy of Variables in Concept Learning

I. Stimulus variables related to:
- A. Concepts
  1. Number of concepts to be learned per trial or block
  2. Time per concept
  3. Order of difficulty of concept
  4. Level of concepts in hierarchy
  5. Perceptual obviousness of concepts
  6. Structure of concepts
  7. Meaningfulness of concepts
  8. Affective content of concepts
  9. Novelty of concepts
  10. Similarity of concepts
- B. Dimensions
  1. Number of values per dimension
  2. Discriminability of values
  3. Number of relevant dimensions
  4. Number of irrelevant dimensions
  5. Sense modality by which dimensions are perceived
  6. Relative salience of dimensions
  7. Subjectivity of dimensions
- C. Instances
  1. Time per instance
  2. Order of instances
  3. Physical location of instances
  4. Number of instances presented
  5. Homogeneity of instances
  6. Associative rank of instances
  7. Number of dimensions varied from instance to instance
  8. Ratio of positive to negative instances
  9. Discriminability of positive from negative instances
- D. Presentation of information
  1. Gross method of instance presentation
  2. Material used to portray stimulus information
  3. Stimulus labelability
  4. Availability of previously presented information
  5. Redundancy of information

II. Instruction variables related to:
- A. General purpose of instructions
  1. Recall of relevant subordinate abilities
  2. Provide advance organizers
  3. Guide thought process
  4. Incorporate an instructional set
  5. Arouse searching orientation
  6. Provide mediators
- B. Specific information in instructions
  1. Number of examples used
  2. Homogeneity of examples
  3. Amount of explanation of stimulus materials
  4. Amount of explanation of principles
  5. Amount of irrelevant information
  6. Information about type of concept
  7. Information about number of relevant dimensions
  8. Information about performance measure(s)
- C. Presentation
  1. Type of exposition
  2. Type of program
  3. Mode of presentation
  4. Time allotted

III. Response variables related to:
- A. Overt responses
  1. Mode of response
  2. Delay of response
  3. Time for response
  4. Activity level of responder
  5. Variance of response dominance
  6. Number of sorting categories

Table 1 (continued)

- B. Inferred responses
  - 1. Use of mediators
  - 2. Type of mediators
  - 3. Use of strategies
  - 4. Type of strategies
  - 5. Level of awareness
  - 6. Type of hypotheses formed
  - 7. Level of cognitive functioning
- C. Assessment of responses
  - 1. Measure of learning and retention
  - 2. Types of errors
  - 3. Transfer tasks

IV. Organismic characteristics

- A. Cognitive
  - 1. Previous achievement or experience
  - 2. General intellectual ability
  - 3. Specific abilities
  - 4. Cognitive style
- B. Psychomotor
- C. Affective
  - 1. Interests
  - 2. Attitudes
  - 3. Values
  - 4. Emotional state
  - 5. Need states
  - 6. Personality integration
- D. Physical
  - 1. Age
  - 2. Sex
  - 3. Handicaps
- E. Socio-cultural
  - 1. Ethnic group
  - 2. Socio-economic level
  - 3. Occupational group
  - 4. Neighborhood
  - 5. Family setting

V. Conditions of learning related to:

- A. Practice
  - 1. Distribution of practice
  - 2. Amount of pretraining
  - 3. Amount of practice in mastering task
  - 4. Amount of overlearning
  - 5. Prompting on practice trials
- B. Feedback
  - 1. Delay of feedback
  - 2. Intensity of feedback
  - 3. Probability of feedback
  - 4. Probability of misinformative feedback
  - 5. Post feedback interval
- C. Experimenter-subject interaction, teacher-pupil interaction
- D. Motivation
  - 1. Peer-group influence
  - 2. Arousal value of task
  - 3. Solubility of task
  - 4. Competition
  - 5. Cooperation
  - 6. Reward and punishment
  - 7. Set to learn
- E. Sequence
  - 1. Interpolated activities
  - 2. Induction-deduction
  - 3. Retroactive-proactive inhibition models

Examination of this taxonomy, Table 1, shows that some liberty has been taken with the term *variables*. There are four main categories of variables: stimulus, instruction, response, and organismic. A fifth grouping, conditions of learning, includes some non-variables. This list, however, provides the framework for experimentation and also for organizing knowledge about concept learning.

The role of mental processes in relation to variables in concept learning was considered to be necessary knowledge for relating concept learning research to instruction in the schools. A set of processes was hypothesized, largely coinciding with cognitive terminology, to guide a series of experiments relating processes to variables. Two of the processes, evaluating and remembering, are assumed to be involved throughout the sequence of concept learning. Others are assumed to be fairly sequential: recognizing the nature of the concept to be learned, discriminating attributes of the concept, selecting instances for testing, cognizing information from instances, verbalizing the concept, and generalizing to other objects and events of the same class.

During the past year most of our research dealt with relationships between process and other variables, or relationships among variables. The three master's theses discussed in this section were approved by committees chaired by Professor Klausmeier; Professor C. W. Harris was a member of two of the committees. A few conclusions from these studies are now presented.

Salience, or dominance, of attributes is a powerful variable. In a master's thesis, Wayne Fredrick reported that more complex concepts were easier to attain than less complex concepts when the attributes of the complex concept were highly salient, in other words readily discriminated. This thesis has been made available as Technical Report No. 3 of the Center.

Since Mr. Fredrick's study, methods are being identified for determining the salience of the attributes of concepts used in laboratory experiments and of concepts in school subject matter. Scaling procedures incorporating the method of paired comparisons were devised. This turned out to be a complicated procedure and its applicability to the usual subject matter of the schools has not been ascertained. With the laboratory material the relative order of salience for both males and females was shape of figure, color of figure, number of figures, size of figures, and texture. Other researchers have obtained similar results; however, one could probably change these results by varying the size of the figure, intensity of color, etc. James Ramsay, Wayne Fredrick and Kent Davis, with the assistance of Professor Chester W. Harris, are continuing this line of investigation.

Performance has been shown to be markedly improved through the use of verbal instructions given to the subjects. For example, giving the subject information about the organization of the material or about a strategy to use in securing information or giving a principle results in improved performance. During the past year two studies involving instructions were completed. Instructions were prepared that would make clear to the subject the nature of the concept he was to attain. In a study by Patricia Kalish for a master's thesis the three independent variables were instructions, level of incentives, and level of competition. The instructed group performed significantly better than the non-instructed

group. Monetary incentives and competition did not have significant effects, most likely because of the relatively small monetary incentive for college age subjects. As yet, instructions have not been written for school-age students related to the usual subject matter, but it is probable that the variables pertaining to instructions can be readily manipulated in programmed instruction.

Inasmuch as students work in groups as well as individually, the attempt was made to determine the effectiveness of groups of varying sizes in attaining concepts. An earlier experiment had shown that quads attain concepts in less time initially than pairs, and pairs in less time than individuals; however, on a transfer task the order of performance was reversed. During the past year Mr. Ramsay reported in a master's thesis a comparison of the performance of individuals and pairs using concepts embedded in two different types of material, figural and verbal. Pairs were found to be superior to individuals with both types of material. Mr. Ramsay explained his results on the basis that pairs are able to gather information more efficiently and also demonstrate superior ability to use information that had been gathered. He has adapted his thesis for publication as Technical Report No. 4 of the Center.

For a doctoral thesis, Mr. Remstad manipulated a number of variables to determine the union of various variables that would produce the most efficient performance. He used experimental material relating to geometric concepts with fifth and sixth grade children in 15 schools. The following eight variables were dealt with: (1) amount of redundant information, (2) mode of presentation of successive instances, (3) ratio of positive and negative instances, (4) order of positive and negative instances, (5) accompanying verbal cues, (6) amount of time the instances were shown, (7) the amount of time between instances, and (8) relative complexity of the concept. Although the data from this study are not completely analyzed, it appears that several of these variables are critical in children's learning concepts of geometric form.

Dr. William Walker has prepared materials and carried out pilot administrations for a study using a symbolic concept system that is based on laboratory experiments. Varying levels of abstractness and generality differentiate the steps of the system.

An investigation of the role of mediation in learning by grade school students was carried out by Kent Davis. His results led him to question the importance of mediation and to design a further clarifying study which will be conducted in the coming year.

In addition to serving as technical advisor, Dr. Chester Harris is conducting an analysis of the nature of concepts and chaired a conference on the analyses of conceptual learning held at the Center October 18-21.[3] The proceedings are to appear in book form. Mr. Remstad and Dr. Walker are involved in the analysis

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[3] Participants in the Conference on the Analyses of Conceptual Learning, in the order they appeared, were: Rom Harré, Jerome Kagan, Philip R. Merrifield, E. James Archer, Benton Underwood, Robert M. Gagné, James Jenkins, Arthur R. Jensen, David Ausubel, J. Richard Suchman, Howard Fehr, Nancy Bayley, Cynthia Deutsch, K. Lovell, Joseph D. Novak, and Stanley Kegler.

of concepts, particularly in the attempt to devise an abstract model for concept types based on set theory.

Laboratory experiments with school age and college age subjects will continue for the purpose of clarifying relationships among processes and variables as exemplified in previous studies; however, most research will be done in the schools. Instructional material that can be programmed to permit manipulation of variables and conditions of learning previously discussed is being identified and prepared for tryout in the schools. The particular variables to be manipulated are being decided on two bases: the variable's strength in previous experiments and its applicability to subject matter incorporated in the curriculum, particularly mathematics, science, and English. As instructional programs and procedures in these subject fields are tested in the schools, integrated studies can be carried out. Knowledge of the relationships between variables, conditions, and processes in concept learning will have progressed to the point that meaningful studies in terms of improving the performance of children can be executed.

COMPUTER SIMULATION

More and more each year computer science is being used for a better understanding of the psychological processes involved in the learning of concepts. The majority of published programs simulating concept learning have added little to our understanding of the learning process. This year Dr. Baker and his assistants began the Concept Attainment Simulation Experiment (CASE) to develop a program which will eventuate in something of psychological significance; the long-range goal is the actual application of new insights to the improvement of classroom learning.

The system for collecting data consists of a closed feedback loop with the simulation program at one end and human learning experiments for protocol gathering at the other. Within the computer program some routines either are based on *a priori* grounds or represent areas not yet clearly understood. During the experiments, subjects are asked questions devised to elicit descriptions of the processes pertaining to these areas. Thus, the computer program guides the production of information within the protocol, which subsequently modifies the program itself.

Protocol gathering was begun by Allan Pratt, who selected six male undergraduates for testing in individual sessions approximately one hour long. Later, Carin Cooper continued the protocol-gathering experiments. At this time an additional four female subjects were selected.

Experimenter's notes and a transcript of the recorded learning session provide a complete protocol. A first analysis of this protocol is carried out by the experimenter. Dr. Frank Baker and his programming assistant Tom Martin perform a further analysis and, when necessary, modify the program. For example, the lack of independence among dimensions necessitated a number of changes in the experimental material and in the computer program; a probabilistic system is now employed for selection of the first attribute to be tested.

Memory has been a primary concern of the computer simulation group. In addition to devoting two of the experimental sessions to the study of memory,

the project personnel have conducted an extensive search of the psychological literature related to memory. A three-level model of memory has been constructed: working memory, short-term memory, and long-term memory. At this time only the first two levels have been programmed.

In their detailed analysis of the learning process, Dr. Baker and Mr. Martin have found that behaviors which seem quite dissimilar share a number of basic information-processing units. The program has generated a number of ideas for classical psychological experiments to investigate such areas as the role of dominant dimensions and the interdependence of dimensions. At the current time the computer program is primarily a medium for expressing and storing the insights and understandings of the concept-learning process which we have acquired. Previous indications that psychological theories might be expressed in the form of computer programs have been substantiated.

CONCEPT LEARNING IN SUBJECT AREAS

MATHEMATICS

Third-grade teachers have proved to be good students and valuable advisors to the mathematics group this year. Video tapes, pupil exercise sheets, and teacher notes for a series of 15-minute lessons broadcast over WHA-TV were introduced to them by Professor Van Engen and his assistants at a conference February 4. The 18 participating teachers represent large and small schools in the Madison area. The basic assumption in this work is that the best way to get a new program in the schools is to get the teachers to use the new program. In other words, the teachers learn while the pupils learn. During the spring, the teachers submitted a running critique of the course through questionnaires completed after each lesson and through periodic seminars. They commented that the video tapes and teacher notes did teach them as well as their students and clarified "new math" to the point of being readily teachable. The series of tapes in Spring 1965 numbered only 16, but in the fall there will be a series of 64 tapes prepared for third grade math and another 32 for Grade 1.

Content of the lessons is based on the most recent studies in mathematics education (arithmetic) and conforms to current thought on curriculum content, utilizing fundamental principles of mathematics. The mathematics specialists who make up the Advisory Group have set the content limits for the lessons and have participated in the critique of the programs.[1] During the fall of 1964, they developed an outline of major concepts to be learned in the elementary grades and specified student abilities associated with the learning of each major concept. The contributions of the Advisory Group and the participating teachers have been, and will continue to be, invaluable for the development of a full series of materials incorporating the best thinking of mathematics experts, curriculum experts, and practicing teachers.

Materials development and field testing are supplemented by a series of experiments concerning the union of two sets and the related idea of conservation of numerousness. Basic to the idea of addition is the concept that if we view two sets of objects and then one set is formed of these two sets the number of objects has not been changed. It was found that children tested in the first grade

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[1] Members of the Mathematics Advisory Group are: Ralph Allen, elementary principal, Madison Public Schools; Adeline Hartung, elementary coordinator, Milwaukee Public Schools; John La Blanc, mathematics consultant, Racine Public Schools; Olive Leary, elementary coordinator, Hales Corners-Whitnall Public Schools; Marion B. Smith, Jr., Vice Chancellor, Center System, University of Wisconsin.

know the combinations 3 + 2 = 5 and 4 + 5 = 9, but they do not comprehend that if we view two sets of three objects and two objects and then place these objects in one pile that the number of objects has not changed. A similar statement can be made for four and five objects. Furthermore, the child's comprehension of this fact seems to have no relation to intelligence. Other factors seem to be playing a key role in this situation.

During the coming academic year Dr. Van Engen plans a number of extensions of the above study. First, it will be repeated in schools using different first-grade programs to see if the type of program affects the outcome. Second, a sample of kindergarten and first-grade teachers in one city will incorporate in their program a series of activities specifically designed to center the child's attention on such ideas as the equivalence of sets and the invariance of numerousness under physical transformations. Next spring four groups of children will be studied relative to these concepts. Another study will be carried out in Grades 1 through 3 to determine whether or not there is a relationship between the phenomena described above and children's inability to solve arithmetic problems usually found in school programs. An exploratory study, also with first, second, and third grade children, will investigate the problem of conservation of length of a moved object. Another exploratory study, this with secondary school pupils, is concerned with students' difficulty in visualizing the intersection of two surfaces, such as a cube and a plane. Results of these studies will be incorporated into future instructional programs.

ENGLISH COMPOSITION

Most of us are acquainted, personally or by observation, with the difficulties borne by some students who year after year have received instruction in traditional grammar but have not absorbed it. Many years ago linguists and grammarians began a new approach to the study of the English language based on usage and actual sentence structure rather than on Latin rules.

The English unit of the Center under Professor Nathan S. Blount is engaged in a long-range project to produce a sentence-building program, dealing with sentence-combining transformations, with the combining of kernel sentences into more complicated sentences. Four Wisconsin high schools participated in preliminary experiments this spring. These studies were patterned on conventional concept-attainment studies using a number of attributes and a variety of values of those attributes. Only eleventh graders were used on the assumption that students at that level would be familiar with the terms *noun*, *verb*, *adjective*, and *adverb* and could point out what was, to them, the most important of the form class attributes (position, inflection, affix, determiner) and, in some cases, the most dominant value of that attribute.

Adjectives are recognized by position, more readily before a noun than after a meaningful linking verb. Although the presence of a determiner aided only slightly in indicating adjectives, some determiners were more effective than others. Adverbs, however, are recognizable by any one of the attributes, although students had trouble recognizing adverbs when neither affix nor inflection

was present. Placement at the end of sentences, its most common position, indicated an adverb more readily than any other position. To be correctly identified with ease, nouns require a combination of two or more of the four attributes. Any one of determiner, inflection, or affix was sufficient for identification of a verb. IQ was a significant variable for all but the adjective studies. Reports describing the studies and results are in preparation.

Professor Blount and his assistants, Shelby Johnson and Robert Trezevant, are presently utilizing the results of a project based on a survey conducted at Florida State University by Kellogg Hunt, who analyzed the elements of syntactic structure at three grade levels—4, 8, and 12. The instructional materials being prepared are intended to combine the elements of structural and transformational grammar which are considered the most useful in teaching eighth graders to handle the sentence structures characteristic of mature writing.

Tasks for the current year include organizing concepts, training in analysis of syntax, writing instructional materials, consulting with linguists and with teachers. In the summer of 1966, a work institute will be held for teachers who will be involved in experimentation. In 1966-1967, the instructional materials will be field tested and re-written for dissemination. At all points in the use of the instructional materials in classrooms, research will be conducted to investigate the efficiency of the "new" grammars in helping the student manipulate, transform, or generate English sentences. Research will also attempt to measure the effects of certain learning variables.

SCIENCE

Dr. Milton Pella and his assistants have been involved in an analysis of the concepts and conceptual schemes in science. In developing an operational definition of concept a large number of articles and books were reviewed but no definitive statement could be found. The definition developed by the group is as follows: A concept is an idea that rationally relates two or more facts; the facts are the sensory experiences received directly or indirectly and may concern the processes of scientific investigation such as an experiment, theory formation, and idealization of data, or the comprehensive products of the processes of science such as the particle nature of matter, force, and equilibrium. Concepts to be developed with pupils will be defined in the manner accepted by the scientific community. In determining how and what the learner has created in the form of concepts, his own definition will be the primary concern.

A knowledge inventory of the processes of science was constructed and administered to high school students during the school year. Before developing the inventory, members of the Science Education group surveyed the scholarly writings of scientists and philosophers in preparation for a working outline reviewed by scholars in history of science, philosophy, and nine scientific disciplines. In the process of the evaluation of the instrument, it was administered to high school science teachers participating in a summer N. S. F. research institute.

During the coming year this group will engage in a detailed analysis of process and product concepts including the determination of the levels of complexity

of the concepts, the facts included in selected concepts, and the relationships that exist among the facts. An attempt will be made to determine the increments of a concept continuum from simple to complex. Following these tasks, the development of teaching techniques, apparatus, and sequences designed for concept development at a variety of levels of complexity and abstraction and providing for a variety of levels of sensory stimuli will be carried out. The materials, sequences, and apparatus will then be tested at several grade levels to ascertain their usability and productivity in concept development. The major effort in science education will be directed towards Grades K-12. Of additional interest is the adult student, and in this regard ideas are being developed in cooperation with the adult re-education unit of the Center for teaching the concept of equilibrium.

SPEECH

Dr. Ronald Allen is concerned with developing instructional materials for teaching concepts related to the structure and support of arguments. A survey of the findings of previous studies considering the teaching of argument and the development of critical thinking ability in children has been completed. Professor Allen and his assistant Jerry Feezel are currently examining the meaningfulness of selected concepts to students of varying ages and intellectual abilities. They will first study the criteria employed by students in assessing the worth of a piece of evidence and the sufficiency of an instance of reasoning, and, second, develop and test instructional units which embrace concepts relevant to the structure and support of arguments.

The final phase of this project will concern an investigation of the effects of certain instructional variables on student acquisition of the above-mentioned concepts. The instructional variables to be tested include positive-negative instances and the deductive-inductive instructional sequences.

POLITICAL SCIENCE

Dr. Jack Dennis and his assistants conducted a study with second and fourth grade children concerning the learning of concepts of political behavior. The investigation, conducted during the national election, was focused on identifying appropriate grade levels and instructional methods for the introduction of citizenship concepts. Analysis of data is still being carried out and will be reported in full when complete. Preliminary analyses indicate confirmation of the hypothesized importance of grade level and teaching methods in the introduction of political concepts. Marked improvement of the instructed group occurred only on selected concepts, many of which are those naturally learned by children of these ages. Two possible factors may have caused these unexpected results: first, there may be "political readiness" which demands extensive instruction before it can be overcome; second, children of these ages may not yet have the necessary political background and capacity for abstractions taught. When completed, the data analysis may offer an accurate explanation.

COORDINATED PROJECTS

CULTURALLY DISADVANTAGED

Our efforts toward improving educational opportunities for the culturally disadvantaged have taken a variety of forms this year. The first was guided by Dr. Julian Stanley who, with his assistants Angela Biaggio and John Samelian, was primarily involved in the educational difficulties of Negro college students in the South. These activities have been suspended until Dr. Stanley's return in the fall of 1966. The major portion of the year was spent by Dr. Stanley's group in studying reports of research in the area of cultural deprivation. In addition to outlining future experimentation, they distributed summaries of current works to other researchers in the field, acting as an information source to a number of persons, both on campus and off, through their newsletter *The Culturally Disadvantaged*.

In August, 1965, Mrs. Biaggio completed her master's thesis concerning the predictive validity of the Scholastic Aptitude Test (SAT) in predominantly Negro and predominantly white Southern state colleges. Her confirmed hypothesis was that prediction of freshman grade point average is equally good for the two groups considered over the four years 1959-62. It has been argued that the test scores are not as predictively valid for Negroes because such tests "discriminate against the culturally disadvantaged." Comparisons for each of the four years for the two test scores for males and females separately totaled 16. When a correction for the restriction in range was applied statistically, 15 of these 16 comparisons showed significantly higher correlations for the Negro colleges. Without the correction, correlations were similar for the males, while correlations of white females were significantly higher than those of Negro females. Mrs. Biaggio presented a portion of these results in a paper at the Inter-American Congress of Psychology in Miami in December, 1964, and is making the full report available for publication as a technical report of the Center.

Tentative research was outlined by Dr. Stanley and his assistants concerning the advancement of persons already considerably disadvantaged verbally, such as a large portion of the freshmen in predominantly Negro state colleges. If was thought that the most practical approach would be one emphasizing subskills for a specific task rather than one designed for general ability improvement; for example, it might be profitable to teach prospective students the vocabulary of the text assigned for a particular course so that classroom learning could be concerned primarily with content. A second proposal pertains to preschool development of cognitive functioning, particularly in acquiring general vocabulary and reading skills. On the premise that instructional procedures should

capitalize on the child's strengths, words such as "up," "down," and "north" might be used to lead a spatially-oriented child with little knowledge of the meaning of words to spatially neutral words.

The second interest area for the culturally disadvantaged is being conducted by Professor Arthur Staats and his assistants. The major plan of Professor Staats is to apply his integrated-functional learning theory of complex human behavior and the methods of experimental psychology to the analysis of the cognitive learning of children. The emphasis in this plan is on reading, writing, and number concept learning. This is being done to both (1) extend and validate the theory and (2) contribute to the understanding and solution of some of the problems of education.

This long term project has moved through several stages. The first step consisted of testing the major principles of the theory in controlled laboratory research using a reading learning task. Part of the research employed standard operant conditioning programming and recording apparatus. In the next step, which was actually conducted concurrently with the first, Professor Staats carried out theoretical analyses of the three areas of cognitive learning and designed materials and apparatus for producing these types of learning in young children. He conducted the validation of these analyses with his own daughter in a series of experiments which extended over a three-year period. When the procedures had been well worked out, they were tested, successfully, for application by other persons to other children.

After systematically organizing the data from the various children, Professor Staats made further theoretical analyses of the three types of cognitive learning, further developed the materials and procedures, and also designed an improved apparatus and experimental unit for conducting additional research. The experimental unit consisted of a large room to be used for a group of children with adjoining rooms for research with individual children.

These developments were the basis for the present project with the culturally-deprived children. Through the cooperation of the Center with the Madison Public Schools, permission was obtained for conducting the research project in Franklin Elementary School. With the help of the building principal, Mr. Leonard Rush, 12 children were selected to participate in the project. Professor Staats also was allotted a large classroom with a stage and an additional small room and used this space to produce the previously designed experimental unit consisting of a large classroom and three small rooms for individual child experimentation.

The experimental unit makes it possible to schedule each of the 12 children for individual experimentation in each of the three areas of cognitive learning during the 3 1/2 hour period they participate each day. When not in the individual experimental sessions, the children are occupied in the general classroom. This laboratory design and procedure represent a unique development for experimental work with children and will be written up for publication, as will a description of the Staats' apparatus.

The materials to be used in the individual training are based upon a detailed and specific stimulus-response analysis of the three types of cognitive learning. Records will be kept of the children's behaviors during the individual experimental

sessions through experimenters' notes and tape recordings. The children earn rewards as they learn, which is a central part of the experimentation.

Although plans, materials, and procedures were worked out previously, as described, work on the project commenced in July. During July and August, Karl Minke helped in preparing the materials and recording procedures to be used, in drawing blueprints so the apparatus could be constructed, and in helping instruct the experimenters in the use of the materials (having received previous experience himself in applying the materials). The experimenters who will conduct the individual training under Professor Staats' supervision are Joan Jacobson, Judy McBurney, and Adrian Van Mondfrans. Michelle Minnis will conduct the general classroom, as well as participate in other research, and has been securing equipment to be used in the classroom. Mr. Minke, who will be occupied with a different research project during the year, will first supervise Miss Minnis in getting the general classroom started along the structured lines necessary for the successful conduct of the project.

A third area of study of the culturally disadvantaged was begun by Professor Klausmeier, Dr. William L. Goodwin, and Professor Goodson in August, 1965. The plan developed is three-fold. Once a month school representatives come to the Center for a seminar on the culturally disadvantaged. Programs, planned to answer the needs of the schools, have included reports of programs conducted in Wisconsin and elsewhere, reports of research on the culturally disadvantaged, and group discussions of problems of general concern that will have slightly varying solutions from school to school.

The Center *Newsletter* will periodically devote full issues to the culturally disadvantaged, reporting programs, research, and reviews of recently published material.

Efforts will be focused on establishing Research and Instruction (R & I) units in schools. These units may include a portion of or an entire school with instructional plans and procedures under the direction of a learning specialist who will participate in the teaching function of the unit a portion of the time. Initially R & I units will be established in the five school systems first affiliated with the Center: Janesville, Madison, Milwaukee, Racine, and West Bend. Later, other schools will participate.

ADULT RE-EDUCATION

Investigations in the area of adult re-education, one completed and two under way, are to determine appropriate means of teaching adults both in established continuing-education programs and in new educational undertakings.

For the purpose of exploring the extent to which language behaviors of two socio-economic groups of rural homemakers differ, Charlotte Martin interviewed rural women of low and middle income. Analysis of language usage, clarity and completeness of ideas, range and number of ideas, as well as expressions of educational needs and of relationship to family and community, revealed a number of differences between the two groups of women. Middle-income rural women were more fluent in their use of language, expressing more ideas in better form

than the low-income women. Generally the middle-income women interviewed were acquainted with educational programs available to them and viewed community activities as an integral part of family life; low-income rural women displayed neither of these attitudes and expressed needs for more basic information than did the middle-income women. Results of this study suggest that an effective continuing-education program will need to incorporate different materials and different types of presentations for low- and middle-income rural women.

Dr. Robert Boyd and Vicki Gabriner were able to gather feasibility data for a study investigating the symbol development of adults at a low socio-economic level. Thirty volunteer illiterates in Tennessee and 12 volunteer literates in Milwaukee took a series of tests selected to measure two-dimensional symbol manipulation abilities. Symbol development was hypothesized to bear direct relevance to reading ability. The study will determine whether or not there are differences in symbol development between literate and illiterate adults of the same socio-economic level. If this feasibility study indicates that such differences do indeed exist, further investigation will be made into the exact nature of the differences. The study will help determine whether or not to pursue further the means by which adults of low literacy and low socio-economic level can be brought into the stream of re-education generally accepted by middle class adults.

The third study in adult learning is focused on the first stages of concept attainment, attention and awareness. Awareness is defined as a kind of behavioral response energized by the learner's set to respond. Professor Burton Kreitlow and Dr. Ludmilla Marin designed the study to ascertain the determinants and extent of differences in adult processes of differentiation of elements in the perceptual field. Fifty adults will receive instruction in the concept of equilibrium, using materials and procedures developed by the Science Education unit of the Center. A second instructional program utilizing concepts in highway safety is being developed. Self-reporting techniques will be utilized to determine the intent, or awareness, influencing the subject's response to instruction. Use of visual, aural, and motor skills is incorporated into the design both in receiving instruction and in responding to it. This concentrated effort to ascertain learning characteristics of adults is seen as a first step in constructing a model of adult conceptual learning.

SOCIAL VARIABLES IN LEARNING

In addition to the concept learning study conducted by Mrs. Patricia Kalish on the effects of motivational variables, a variety of work in motivation and social learning has been done. Although Dr. Thomas Johnson's departure from the University on September 3 will result in a change of focus in the motivational research conducted at the Center, the motivational aspects of learning will be investigated in conjunction with other variables.

Development of a laboratory instrument to be used as a standard in measuring the effects of motivational variables was the primary project during the past year. A puzzle-like task which requires no special skill has been constructed, and preliminary investigation of the parameters of the task has been completed.

Also, exploratory data has been gathered on an instrument composed of TAT-type pictures constructed to ascertain the conditions under which children perceive themselves or others as the source of consequences. The study will eventuate in a number of suggested methods by which teachers could facilitate the development of intrinsic motivation in pupils.

Thelma Baldwin carried out a study designed to investigate the interaction between teacher power and efficacy of social reinforcement. In manipulating teacher power, Miss Baldwin varied punitiveness and expertise in tape recordings representing a high school social studies class. After listening to the recording, students completed a questionnaire. Two of the students were then selected for an interview with the teacher after which they completed another questionnaire. Responses to the questionnaires and operant rate during the interview constituted the data of the study. Expertise manipulations produced no significant effect on the operant rate; however, punitiveness and reinforcement interacted, with nonpunitive teachers eliciting a higher operant rate when administering social reinforcement, and punitive teachers eliciting a higher operant rate under nonreinforcement conditions.

Themes and listening patterns in teenage music were defined and related to academic and peer variables by Ronald Burke. After responding to a personal information questionnaire concerning their music-listening habits, academic standing and aspirations, and peer and parental control, junior high school students ranked song excerpts on a best-liked to least-liked scale. As hypothesized, there was a significant inverse relationship between grades and time spent listening to music. Analysis of preferred themes with the cultural variables indicated that teenagers find solace in the themes which can be a guide for expressing feelings or a means for articulating fantasies.

INSTRUCTIONAL TELEVISION

The diverse activities of Center staff members working in instructional television have all been directed toward optimum use of the medium for improved instruction. The year's most dramatic project was the first instructional use of the intercontinental Early Bird Satellite. The broadcast, first devised by Dr. Lee S. Dreyfus three years ago in connection with Telestar, was completed this spring with the cooperation of Radiodiffusion-Télévision Française, American Telephone and Telegraph, and the West Bend, Wisconsin, schools under Superintendent Paul Loofboro. For about one hour, students in West Bend High School and students in Lycée Henri IV in Paris exchanged languages in a teenage conversation. In addition to the broadcast's obvious instructional and motivational value, it enabled a large number of persons to participate directly in a cultural exchange and should lead to more immediate exploitation of the scientific achievement as an educational tool.

Professor Gary Gumpert, in cooperation with the State Department of Public Instruction, directed a survey of all Wisconsin school television facilities. The results of this survey will enable better selection of sites of experimentation and better dissemination of video tapes. In some areas, it was apparent that there

was only a limited number of sending stations that could be utilized for transmitting programs into experimental classrooms. Therefore, for both media research and learning research, the Center purchased a mobile television unit which will be in operation by the second semester of the 65-66 school year. It consists of three video tape recorders and monitors permanently installed in a van and 12 portable receiving units ready for use in classrooms. Three programs may be sent into a school simultaneously to a total of 12 receivers. Facilities of WHA-TV, the University of Wisconsin channel, will be used for preparing the video tapes.

Dr. Bruce Westley and Hower J. Hsia planned a series of experiments investigating television and film on a within-media basis. In addition to color and continuous sound, they have identified four sign-systems which will be varied in combination and alone: orthographic language, aural-oral, gestural, and graphic (animation). Continuity of modalities is assumed to be a significant variable. At this time, the results of a search of the literature on learning and on information processing have been compiled into a preliminary theory relating the two fields. Following the initial stages of research during the 65-66 year, varying conditions of feedback may also be included in the study.

An extensive bibliography of the literature on instructional television was begun in 1965. Meredith Church abstracted, categorized, and cross-referenced over 500 entries, only a small part of the total. The project was begun to assure that current and past findings would be readily available to producer-directors for application in current productions and lessons. Due to the size of the bibliography, the project will be transferred to the Speech Radio-Television Bibliography Center at the University for completion.

Kenneth Swerdlow, under the direction of Professor Dreyfus, completed a pilot study last summer investigating the differential effects of violence viewed on television or on a movie screen in inducing hostile/aggressive behavior. The results suggest that differences in viewing conditions between the two media are great enough that effects resulting from viewing of one cannot be assumed to also result from viewing of the other.

In summary, the staff members of the Center's television unit play a dual role: in addition to designing and carrying out their own research, they act as consultants, producers, and directors to other Center units preparing televised instruction.

METHODOLOGICAL INVESTIGATIONS

This type of study is particularly relevant to the Center's plans for long-term research in the schools. Dr. William L. Goodwin researched a variety of arrangements for data collection; Professor Hagstrom has prepared a working paper concerned with acceptance of innovations in the schools and has outlined organizational factors facilitating and inhibiting such acceptance. His organizational recommendations are taken into account in the design for Project MODELS, described in the next section of this report. He suggests that there are three effective organizations for educational change: research in the school system,

research outside the school system, and a combination of the two. The combination approach is customarily temporary but is able to produce change because of its unusual quality. Outside researchers, often from a university, may find themselves sought after as service personnel in connection with ongoing projects in the schools. Inside research can be effective if the system is organized for innovation. Dr. Hagstrom cites three conditions necessary for an effective research system within schools: first, the research system should be separate from service units such as those responsible for the school's testing program; second, the director of the unit should report directly to the superintendent for most effective communication and implementation of developments; third, school research work must be seen as a career with defined training programs and opportunities for advancement. In a closing statement, Dr. Hagstrom cites the need for means of evaluating innovations to avoid "fashionable" changes or change for change's sake.

Dr. Goodwin investigated the effects on experimental results of using classroom teachers as sub-experimenters to administer experimental treatments and to collect data. One of his primary concerns was the effectof the experimental atmosphere created, which could potentially lead to a Hawthorne effect on the subjects that would increase their scores or an unintentional transmission of sub-experimenter bias from teachers to students. Students of teachers who were informed of the experiment well in advance of the testing date did perform slightly better than other students. This effect of advance notice was particularly evident on non-routine test items and was interpreted by Dr. Goodwin as evidence of the teachers' interest in such unusual items. In general, students who were administered the test by their teachers obtained higher scores than students who were administered the test by outside personnel; Dr. Goodwin suggests that it might have been the result of better rapport existing when a familiar person administers the test. Scoring was done by teachers and by outside personnel,and both types of scorers produced similar error rates. Dr. Goodwin concludes that tests might best be scored by machine or by persons unfamiliar with either the project or the subjects, yet persons known to be competent scorers. This study is available as Technical Report No. 2 of the Center.

NEW PROJECTS AND PLANS

LABORATORY EXPERIMENTS ON PROBLEM SOLVING

Dr. Gary Davis joined the Center this summer after receiving his Ph.D. in psychology at Wisconsin. He is engaged in a long-range project one purpose of which is to identify and evaluate the effects of basic stimulus and response variables in human problem solving. The problem-solving task used thus far can be solved by overt trial-and-error learning or, after pretraining, by covert "insightful" behavior. Thus the effects of any variables manipulated can be compared in the two basic forms of problem solving. Present experiments employ variations in amount of misinformation, total available responses, and in responses required for solution. In addition to basic research activities, Dr. Davis recently completed a critical review of recent theory and research in human problem solving; and a second review dealing with the training of originality and creative problem solving is in the planning stages. Future research may thus be concerned with both the effects of basic variables in problem solving and with the teaching of efficient problem solving techniques.

PROJECT MODELS

Of the 13 original school systems in the Schools-Center Planning Group, five have become "pilot schools" for the purpose of facilitating more highly organized experimentation: Madison, Janesville, Racine, Milwaukee, and West Bend. Project MODELS (Maximizing Opportunities for Development and Experimentation in Learning in the Schools) is being developed formally by Co-directors Klausmeier and Goodson and Dr. William Goodwin as an instrument of close cooperation between the Center and these pilot school systems. MODELS will help to answer three needs: (1) Certain empirical generalizations, identified from the laboratory research conducted the first year and still in progress, as well as from other sources, require further research and development in the locale of the school. (2) Experimentation of a larger scale and of a longer duration than previously appropriate in the school locale is necessary for the further investigation and development of promising ideas. (3) Various projects of the Center such as those in concept learning and instruction in science, English, and mathematics now need to converge toward one another and to become more closely integrated. Project MODELS can facilitate the needed converging and integrating through certain phases of the projects being programmed in the same school with the same teaching staff and the same population of students.

From the point of view of the schools there is need for the development of an organization that will enable their personnel to identify their significant research and development problems which require an approach of innovation and study. This need of the schools and the three needs of the Center come together with sufficient mutuality for the five pilot schools and the Center to jointly engage in Project MODELS.

The first phase of Project MODELS will focus upon formulating significant research and development problems and simultaneously establishing experimental Research & Instructional (R & I) units within the structure of the school system. The second phase will have a concern with the study and modification of school structures.

There is a common body of professional opinion that schools are not organized presently to carry out controlled experimentation effectively, to develop new instructional procedures, and to test innovations. It appears that a new organization for instruction is required. Project MODELS will be directed toward the task of exploring the variables that are involved in a new organization or new organizations.

The plan for Phase I of MODELS is to proceed in a three-step sequence. First, identify and refine significant research-development and innovation problems to be dealt with. Second, identify the possible structural units that may be applicable in the various school systems. Third, plan an institute for the summer session of 1966 in which R & I units and other personnel, such as members of the central staff, would make specific plans for the 1966 school year.

One organizational unit that is being considered includes a learning specialist directly responsible for the education of about one hundred children. With the learning specialist there would be two certified teachers, a full-time lay person, a part-time secretary, hourly clerical help, and perhaps an intern who is preparing to become a learning specialist. The learning specialist would supervise the entire instructional unit and work directly with children at least half of the school day, with the other half of his time available for planning with the building principal, supervisors, and university personnel. He would be employed on a twelve-months basis and receive an annual salary well above that of the regular teachers. He would be especially prepared as an expert in diagnosing and analyzing learning needs of children, in prescribing educational treatments, and in giving guidance to others in administering teaching procedures. Of great importance, he would have an interest and competence in carrying research and development responsibilities.

The second phase of Project MODELS is designed to go beyond the establishing of experimental units in which to conduct research, and is concerned with the added task of studying the change processes whereby schools introduce innovations and make adaptations. This phase is closely related to the strategic and selective dissemination function of the Center. It has as its premise that schools need to be examined and experimentally modified in order to create the knowledge necessary for designing school structures that enhance organizational health and the capacity for renewal and change. Without such a fundamental approach to the organizational problem, the products of new knowledge and tested instructional models produced by this, or any other, Center may be disseminated

to school structures and related personnel with a low receptivity and readiness for change. As a consequence, the risk is great that schools will not change by incorporating tested innovations and by becoming more experimentally and research oriented as expressed in their institutional culture, unless the second phase of Project MODELS is executed.

An assumption of this phase is that there are adaptive structures that can be created—the experimental unit and the learning specialist role of Phase I being examples—and that personnel can be prepared to function in new structures so as to enhance the readiness and efficiency by which a school can continuously reduce its obsolescence and take on innovations. Phase II is concerned, therefore, with the variables of school organization that have an impact on the opportunities for development in experimentation and learning. These variables have to do with roles in the central office and in the school unit, problem-solving skills of personnel and their capacities to communicate and to cooperate, and factors involved in creating an atmosphere that supports change and improvement.

In summary, Phase I gives attention to the phenomena associated with improving learning through more sophisticated research and development, while Phase II is expected to produce knowledge that can be used in designing and operating a more viable and productive organization of schools in respect to continued improvement in the future.

OVERVIEW OF THE COMING YEAR

The experiments on problem solving and Project MODELS just described are the major additions to our research program. Other projects discussed will continue and will expand research and development activities along the lines suggested by Figure 1. Bibliographic activities undertaken this first year are generally up to date, permitting us to maintain our review of the literature with current publications and to concentrate to a greater extent on research projects suggested by our literature search and analysis.

Three additional developments are planned for the coming year. First, we hope to acquire staff for a technical section with experimental design and measurement persons who will serve as consultants and advisors to all units of the Center. A search for adequate housing for the Center is under way which, when completed, will satisfy our present needs for more working and consulting space as well as allow for future expansion. We plan to arrange for publication of a book containing the proceedings of the Conference on the Analyses of Conceptual Learning and are producing a series of technical reports based on major research projects.

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